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IS 4663 (1968) : Permanent Rubber-based Adhesives for Footwear Industry [PCD 12: Plastics]

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Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”



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(1991-06)

Indian Standard

**SPECIFICATION FOR
PERMANENT RUBBER-BASED ADHESIVES
FOR FOOTWEAR INDUSTRY**

(Incorporating Amendment Nos. 1, 2 & 3)

UDC 668.395 : 685.3

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Group 4

Indian Standard

**SPECIFICATION FOR
PERMANENT RUBBER-BASED ADHESIVES
FOR FOOTWEAR INDUSTRY**

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Indian Standard

SPECIFICATION FOR
PERMANENT RUBBER-BASED ADHESIVES
FOR FOOTWEAR INDUSTRY

0. F O R E W O R D

0.1 This Indian Standard was adopted by the Indian Standards Institution on 8 May 1968, after the draft finalized by the Adhesives Sectional Committee had been approved by the Chemical Division Council.

0.2 These types of adhesives are used for bonding leather upper; leather sole; and microcellular, natural and synthetic rubber soles to one another in the manufacture of footwear. They give permanent bond where no subsequent stitching is necessary. Adhesives used in footwear industry are based on natural latex or natural rubber or synthetic rubber compounded with suitable materials.

0.3 In the preparation of this standard, considerable assistance has been derived from the data collected by the Central Leather Research Institute, Madras.

0.4 This standard contains requirement for consistency (2.1) and shear strength (2.3) which call for agreement between the purchaser and the supplier.

0.5 This edition 1.3 incorporates Amendment No. 3 (June 1991). Side bar indicates modification of the text as the result of incorporation of the amendment. Amendment Nos. 1 & 2 had been incorporated earlier.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for permanent rubber-based adhesives used in footwear industry. These adhesives are used for bonding the soles of leather, rubber or other elastomers of footwear to the middle sole or upper leather.

2. REQUIREMENTS

2.1 Consistency — The material shall be of a consistency suitable for its mode of application, or as agreed to between the purchaser and the supplier.

*Rules for rounding off numerical values (*revised*).

2.2 Peeling Test

2.2.1 When tested as prescribed in Appendix A, the joint in the test specimen shall withstand the minimum load given in col 9 of Table 1.

2.2.2 Peeling Load After Immersion in Water— The test specimen prepared as prescribed in Appendix A shall be immersed in water at $27^\circ \pm 2^\circ\text{C}$ for 24 h and then tested for peeling load as prescribed in Appendix A. The peeling load shall be not less than the value given in col 10 of Table 1.

2.2.3 Peeling Load After Heat Ageing— The test specimen prepared as prescribed in Appendix A shall be kept in an air oven maintained at a temperature of $70^\circ \pm 2^\circ\text{C}$ for 100 h and then tested for peeling load as prescribed in Appendix A. The peeling load shall be not less than the value given in col 11 of Table 1.

2.3 Strength of Joint in Shear— Subject to agreement between the purchaser and supplier, the material shall be tested for shear strength of joint as given in **2.3.1**, **2.3.2** and **2.3.3**.

2.3.1 When tested as prescribed in Appendix B, the joint in the test specimen shall have shear strength value not less than that given in col 9 of Table 2.

2.3.2 Shear Strength After Immersion in Water— The test specimen prepared as prescribed in Appendix B shall be immersed in water at $27^\circ \pm 2^\circ\text{C}$ for 24 h and then tested for shear strength as prescribed in Appendix B. The shear strength shall be not less than the value given in col 10 of Table 2.

2.3.3 Shear Strength After Heat Ageing— The test specimen prepared as prescribed in Appendix B shall be kept in an air oven maintained at a temperature of $70^\circ \pm 2^\circ\text{C}$ for 100 h and then tested for shear strength as prescribed in Appendix B. The shear strength shall be not less than the value given in col 11 of Table 2.

2.4 Keeping Qualities— The material shall comply with the requirements specified in **2.1** to **2.3** when it has been stored in the original closed containers according to the manufacturer's instructions and up to the date recommended by the manufacturer.

3. PACKING AND MARKING

3.1 Packing— The material shall be securely packed as agreed to between the purchaser and the supplier.

3.2 Marking— The packages shall be marked legibly and indelibly with the following information:

- a) Name of the material;
- b) Manufacturer's name and recognized trade-mark, if any;
- c) Date by which the material becomes unusable;
- d) Weight or volume of the material in the package;
- e) Directions for storage, if any;
- f) Batch number or month and year of manufacture; and
- g) Time taken, if any, for attaining the full bond strength.

TABLE 1 PEELING LOAD, Min
(*Clauses 2.2.1, 2.2.2 and 2.2.3*)

SL. No.	COMPONENT A			COMPONENT B			TEST SPECI- MEN PRE- PARED AS PREScribed IN CLAUSE	PEELING LOAD (kg/cm)		
	Material	Thickness	Hardness (Shore)	Material	Thickness	Hardness (Shore)		Dry	Wet	Aged
(1)	(2)	(3) mm	(4)	(5)	(6) mm	(7)	(8)	(9)	(10)	(11)
i)	Chrome retan upper leather*	1.6 ± 0.2	—	Vegetable tan sole leather†	4.0 ± 0.4	—	A-3.1	4.0	2.5	3.5
ii)	Chrome retan upper leather*	1.6 ± 0.2	—	Natural rubber sole	‡	85°	A-3.2	4.0	4.0	3.5
iii)	Chrome retan upper leather*	1.6 ± 0.2	—	Prevulcanized natural and synthetic rubber combination sole	‡	88°	do	4.0	2.5	4.0
iv)	Chrome retan upper leather*	1.6 ± 0.2	—	Synthetic rubber sole	‡	80°	do	3.5	3.0	3.5
v)	Microcellular rubber sole	‡	60°	Synthetic rubber sole	‡	80°	A-3.3	4.5	4.5	3.5
vi)	Microcellular rubber sole	‡	65°	Synthetic rubber sole	‡	80°	do	4.5	4.5	3.0
vii)	Microcellular rubber sole	‡	70°	Synthetic rubber sole	‡	80°	do	4.5	4.5	2.0
viii)	Prevulcanized natural and synthetic rubber combination midsole	‡	92°	Microcellular rubber sole	‡	70°	do	3.5	3.5	1.0
ix)	Microcellular rubber midsole	‡	60°	Microcellular rubber sole	‡	65°	do	2.5	2.5	1.0

*Conforming to IS : 2961-1965 'Specification for chrome retan upper leather'. (Since revised).

†Conforming to IS : 579-1962 'Specification for sole leather (revised)'.

Where no specific thickness is given, the thickness of the components shall be as generally adopted in footwear manufacture subject to provisions made in A-3.2 and A-3.3.

TABLE 2 SHEAR STRENGTH, Min
(Clauses 2.3.1, 2.3.2 and 2.3.3)

SL. NO.	COMPONENT A			COMPONENT B			TEST SPECI- MEN PRE- PARED AS PREScribed IN CLAUSE	SHEAR STRENGTH (kg/cm ²)		
	Material	Thickness	Hardness (Shore)	Material	Thickness	Hardness (Shore)		Dry	Wet	Aged
(1)	(2)	(3) mm	(4)	(5)	(6) mm	(7)	(8)	(9)	(10)	(11)
i)	Chrome retan upper leather*	1.6 ± 0.2	—	Vegetable tan sole leather†	4.0 ± 0.4	—	B-3.1	16.0	12.5	16.0
ii)	Chrome retan upper leather*	1.6 ± 0.2	—	Natural rubber sole	‡	85°	B-3.2	23.0	22.5	23.0
iii)	Chrome retan upper leather*	1.6 ± 0.2	—	Prevulcanized natural and synthetic rubber combination sole	‡	88°	do	18.0	18.0	11.5
iv)	Chrome retan upper leather*	1.6 ± 0.2	—	Synthetic rubber sole	‡	80°	do	13.0	13.0	11.5
v)	Microcellular rubber sole	‡	70°	Synthetic rubber sole	‡	80°	B-3.3	19.0	19.0	14.0
vi)	Prevulcanized natural and synthetic rubber combination mid-sole	‡	92°	Microcellular rubber sole	‡	70°	do	19.0	18.0	14.0
vii)	Microcellular rubber midsole	‡	60°	Microcellular rubber sole	‡	65°	do	16.0	13.0	5.0

*Conforming to IS : 2961-1965 'Specification for chrome retan upper leather'. (Since revised).

†Conforming to IS : 579-1965 'Specification for sole leather (revised).

‡Where no specific thickness is given, the thickness of the components shall be as generally adopted in footwear manufacture subject to provisions made in **B-3.2** and **B-3.3**.

3.2.1 The manufacturer shall also furnish written instructions on the lines as given below, giving the manner in which the adhesive shall be used:

- a) Preparation of surfaces of sole and upper leather;
- b) Method(s) of application, such as single or double spread;
- c) Maximum and minimum open and closed assembly times; and
- d) Recommended pressure in kg/cm² and duration and temperature in °C to be applied for bonding the two components.

3.2.2 The packages may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

4. SAMPLING

4.1 Representative test samples of the material shall be prepared as prescribed in Appendix C.

5. TESTS

5.1 For carrying out tests prescribed in 2, the adhesive shall be prepared according to the instructions of the manufacturer.

5.2 For the preparation of joints for test, detailed methods laid down in Appendix A and Appendix B shall be followed, keeping in view the manufacturer's instructions (see 3.2.1).

5.3 Tests shall be conducted as prescribed in Appendix A and Appendix B of this standard.

A P P E N D I X A

(Clauses 2.2.1, 2.2.2 and 2.2.3)

PEELING TEST

A-1. APPARATUS

A-1.1 Tensile Testing Machine — Any suitable motor-driven, tensile strength testing machine may be used. The capacity of the

machine shall be such that any reading taken during or on completion of the test shall fall within the loading range (loading range being the range within which the indicated load shown by calibration is correct within ± 1.5 percent). The speed of the moving head of the tensometer when running free shall be 250 ± 50 mm per minute.

A-1.2 Roller — A steel roller of 135 ± 2 mm diameter and 90 ± 1 mm width covered with rubber approximately 6 mm thick having a hardness of 80 ± 1 . The weight of the roller, which applies pressure to the specimen, shall be 10 kg. It shall be so constructed that the weight of the handle is not added to the weight of the roller during use (see Fig. 1)

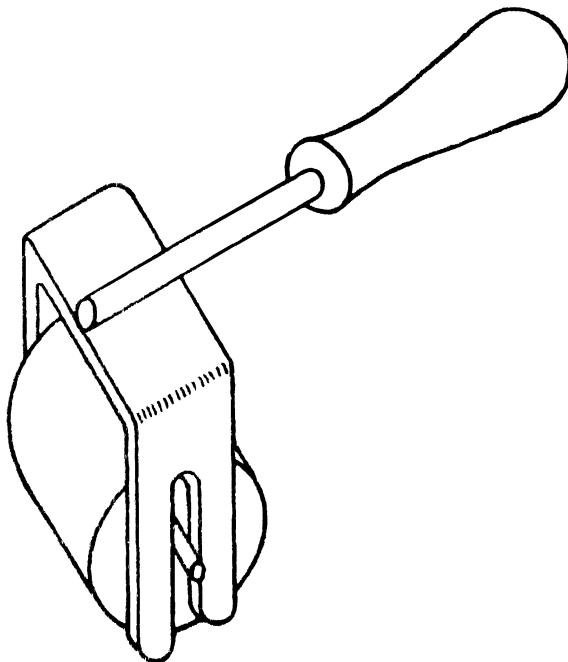


FIG. 1 ROLLER

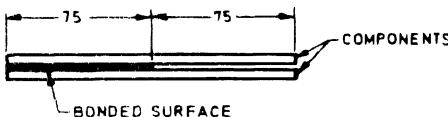
A-2. NUMBER OF TEST SPECIMENS

A-2.1 Test shall be carried out on three test specimens.

A-3. PREPARATION OF TEST SPECIMENS

A-3.1 Leather to Leather Specimens — Take strips of each component of uniform thickness, measuring 150×25 mm. Buff the

surface on the flesh side with emery coated abrasive paper No. 50 (*see IS : 715-1962**) and then dust off with a flat 2.5 cm brush. Over an area measuring 75 × 25 mm at one end of the buffed surface of each strip, apply sufficient quantity of the adhesive so that the pores, if any, are completely filled and there is a thin uniform layer of the adhesive formed. When the adhesive surface is dry, apply another coat of the adhesive in the same manner. When the second adhesive film is dry to a point when there is still an aggressive tackiness but no tendency for the film to lift when tested with a finger, align the coated surface of the two strips face to face carefully, without entrapping air, in such a way that the free ends of the strips lie in the same direction (*see Fig. 2*). Move the roller on the assembled specimen five times. Allow the bonded specimen to dry under prevailing conditions of temperature and humidity for 24 h.



All dimensions in millimetres.

FIG. 2 TEST SPECIMEN FOR PEELING TEST

A-3.2 Leather to Rubber Specimens — Take a strip of leather component of uniform thickness, measuring 150 × 25 mm and prepare it for bonding as in A-3.1 (applying two coats of the adhesive). For the rubber component, take a strip measuring 150 × 25 mm and thickness not more than 3 mm. Buff the rubber surface with emery coated abrasive paper No. 50 (*see IS : 715-1962**) and then dust off with a flat 2.5 cm brush. Immediately after preparing the rubber surface, apply sufficient quantity of the adhesive so that the pores, if any, are completely filled and there is a thin uniform layer of the adhesive formed. When the adhesive film on the two strips is dry to a point when there is still an aggressive tackiness but no tendency for the film to lift when tested with a finger, align the coated surfaces of the two strips face to face and prepare the bond as in A-3.1.

A-3.3 Rubber to Rubber Specimens — Take strips of each component of uniform thickness, measuring 150 × 25 mm. The thickness of each of the rubber components shall be not more than 3 mm. Prepare the surface for bonding and then the joint as in A-3.2.

A-4. CONDITIONING

A-4.1 Condition the test specimens for 48 h at a temperature of $27^\circ \pm 2^\circ\text{C}$ and 65 ± 5 percent relative humidity.

*Specification for coated abrasive, glue-bond (*revised*). (Since revised).

A-5. PROCEDURE

A-5.1 Fix the two free ends of the test specimen in the two jaws of the testing machine. The pawls shall be disengaged so that the pendulum may move to and fro. Record the load required to separate the joint.

A-6. REPORT

A-6.1 Report the peeling load in kg/cm, calculated from the load required to separate the joint and the width of the joint, for each test specimen and the mean of the three values.

A P P E N D I X B

(*Clauses 2.3.1, 2.3.2 and 2.3.3*)

TEST FOR SHEAR STRENGTH OF JOINT

B-1. APPARATUS

B-1.1 Tensile Testing Machine — Same as in **A-1.1**.

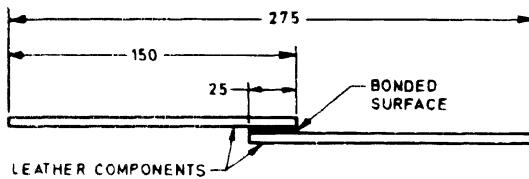
B-2. NUMBER OF TEST SPECIMENS

B-2.1 Test shall be carried out on three test specimens.

B-3. PREPARATION OF TEST SPECIMENS

B-3.1 Leather to Leather Specimens — Take strips of each component of uniform thickness, measuring 150×25 mm. Buff the surface on the flesh side with an emery coated paper No. 50 [see IS : 715 (Part I)-1976*] and then dust off with a flat 2.5 cm brush. Over an area measuring 25×25 mm at one end of the buffed surface of each strip, apply sufficient quantity of the adhesive so that the pores, if any, are completely filled and there is a thin uniform layer of the adhesive formed. When the adhesive surface is dry, apply another coat of the adhesive in the same manner. The substrate should be put to elevated temperature between 70 to 80°C for 5 minutes before pressing face to face carefully, without entrapping air in such a way that the free end of the strips lie in opposite direction (see Fig. 3). Press the joint in a suitable press at a pressure of 8 to 10 kg/cm^2 . Allow the bonded specimen to dry under prevailing conditions of temperature and humidity for 24 hours.

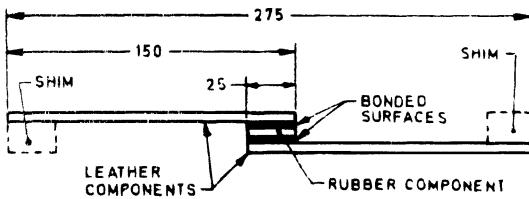
*Specification for coated abrasives: Part I General applications (*third revision*).



All dimensions in millimetres.

FIG. 3 LEATHER TO LEATHER TEST SPECIMEN FOR SHEAR STRENGTH

B-3.2 Leather to Rubber Specimens — Take two strips of leather component of uniform thickness, measuring 150×25 mm and prepare them for bonding as in **B-3.1** (applying two coats of the adhesive). For the rubber component, cut a 25 mm square piece of thickness not more than 3 mm. Buff both faces of the rubber piece with an emery coated paper No. 50 (see IS : 715-1962*) and then dust off with a flat 2.5 cm brush. Immediately after preparing the rubber surface, apply sufficient quantity of the adhesive on both faces so that the pores, if any, are completely filled and there is a thin uniform layer of adhesive formed. When the adhesive film on the two leather strips and the two faces of the rubber piece has dried to a point where there is still an aggressive tackiness but no tendency for the film to lift when tested with a finger, joint the two leather strips to the two faces of the rubber piece in such a way that the free ends of the leather strips lie in opposite directions (see Fig. 4). Then prepare the bond as in **B-3.1**.



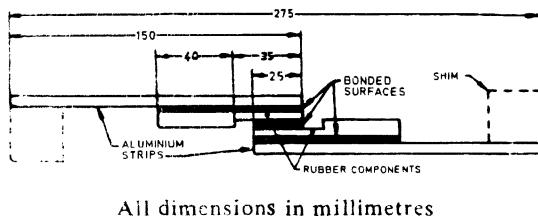
All dimensions in millimetres.

FIG. 4 LEATHER TO RUBBER TEST SPECIMEN FOR SHEAR STRENGTH

B-3.3 Rubber to Rubber Specimens — Take two rubber pieces of 75×25 mm of thickness not more than 2.5 mm. To prepare the surface for bonding, rub a length of 35 mm of the two rubber pieces to get a surface of thickness 1.5 mm. Then take two strips of aluminium measuring 150×25 mm of thickness 1.6 mm. The rubber pieces of

*Specification for coated abrasive, glue-bond (revised). (Since revised).

75 mm length may be fixed to aluminium strips by an adhesive (other than the sample) which shall be capable of giving a joint between aluminium strip and the rubber components that will not fail before the failure of the joint between the two rubber components. Then a joint of 25 mm square is made between the two rubber components on the specially prepared portion of the rubber components by using the adhesive under test (*see Fig. 5*). Press the joint and dry as in **B-3.1**.



All dimensions in millimetres

FIG. 5 RUBBER TO RUBBER TEST SPECIMEN FOR SHEAR STRENGTH

B-4. CONDITIONING

B-4.1 Condition the test specimens for 48 h at a temperature of $27^\circ \pm 2^\circ\text{C}$ and 65 ± 5 percent relative humidity.

B-5. PROCEDURE

B-5.1 Fix the two free ends of the test specimen in the two jaws of the testing machine which shall be 125 mm apart. Use shims (Note) in the grips as shown in Fig. 4 and Fig. 5 so that the test specimen is properly centred and is held straight in the grips and the applied force is in the plane of the bonded area. Record the load required to separate or break the joint, whichever is less.

NOTE — The shims may be blocks of metal, wood or similar material. The thickness of the shim shall be such that the sum of its thickness and that of the free end of the strip shall be equal to the total thickness at the sandwich area.

B-6. REPORT

B-6.1 Report the shearing strength in kg/cm^2 , calculated from the load required to separate or break the joint and the area of the joint, for each test specimen and the mean of the three values.

A P P E N D I X C

(*Clause 4.1*)

SAMPLING OF ADHESIVES FOR FOOTWEAR INDUSTRY

C-1. GENERAL REQUIREMENTS OF SAMPLING

C-1.1 Samples shall not be taken in an exposed place.

C-1.2 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination.

C-1.3 Sample shall be placed in suitable, clean, dry and air-tight glass containers.

C-1.4 Each sample container after filling shall be sealed air-tight and marked with full identification particulars, such as, sample number, the date of sampling, the batch of manufacture of material and other important particulars of the consignment.

C-1.5 Samples shall be protected from excessive variations of temperature.

C-2. SCALE OF SAMPLING

C-2.1 Lot — All the containers of one size in a single consignment of the material, containing material of the same batch of manufacture, shall constitute a lot.

C-2.1.1 Samples shall be tested for each lot for ascertaining conformity of the material to the requirements of the specification.

C-2.2 The number of containers (n) to be selected from a lot shall depend on the size of the lot (N) and shall be in accordance with col 1 and 2 of Table 3.

C-2.2.1 The containers shall be selected at random and in order to ensure the randomness of selection, a random number table shall be used. In case such a table is not available, the following procedure may be adopted:

Starting from any container, count them in one order as 1, 2, 3,....., up to r and so on, where r is the integral part of N/n (N being the lot size and n the number of containers to be selected). Every r th container thus counted shall be withdrawn to give sample for test.

TABLE 3 NUMBER OF CONTAINERS TO BE SELECTED FOR SAMPLING

(*Clause C-2.2*)

LOT SIZE	NUMBER OF CONTAINERS TO BE SELECTED
<i>N</i>	<i>n</i>
(1)	(2)
Up to 20	3
21 „ 40	4
41 „ 80	5
81 „ 120	6
121 „ 200	8
201 and above	10

NOTE — In the case of very small lots where the selection of three containers may be uneconomical, the number of containers to be selected and the criterion for judging the conformity of the lot to the specification shall be as agreed to between the purchaser and the supplier.

C-3. PREPARATION OF TEST SAMPLES AND REFEREE SAMPLE

C-3.1 To ensure that the sample taken from each container is representative of the contents, the contents shall be mixed thoroughly by shaking or by stirring or both.

C-3.2 After the contents are thoroughly mixed, a small representative portion of the material shall be drawn with the help of a suitable sampling implement from each of the containers selected according to **C-2.2** (the approximate quantity of material to be drawn from a container shall be thrice the quantity required for the tests indicated in 2).

C-3.3 In case a thorough mixing by shaking or stirring cannot be attained, small representative portions of the material shall be drawn from different parts of the container with the help of a suitable sampling instrument so as to give representative sample for the container.

C-3.4 The material drawn from each container shall be divided into three equal parts, each forming an individual sample. One set of the individual samples representing *n* containers selected shall be marked for the purchaser, another for the supplier and the third for the referee.

C-3.5 All the samples shall be transferred to separate containers. These containers shall then be sealed air-tight and labelled with full identification particulars given in **C-1.4**.

C-3.6 The referee sample consisting of a set of n individual samples representing n containers selected shall bear the seals of both the purchaser and the supplier. They shall be kept at a place agreed to between the purchaser and the supplier, and shall be used in case of any dispute between the two.

C-4. NUMBER OF TESTS

C-4.1 Tests for the determination of all the requirements of the specification given in **2** shall be performed on each of the individual samples separately.

C-5. CRITERIA FOR CONFORMITY

C-5.1 A lot shall be declared as conforming to the requirements of this specification if the different test results obtained meet the corresponding requirements given in this standard.

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